PHYSICS AND ELECTRONICS

05 Mar 2012

Dr. Patrick Carrick
Director
AFOSR/RSE
Air Force Research Laboratory

Integrity ★ Service ★ Excellence

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
05 MAR 2012		**00-00-2012 to 00-00-2012**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Physics And Electronics	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Air Force Research Laboratory ,Wright-Patterson AFB,OH,45433-**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Presented at the Air Force Office of Scientific Research (AFOSR) Spring Review Arlington, VA 5 through 9 March, 2012

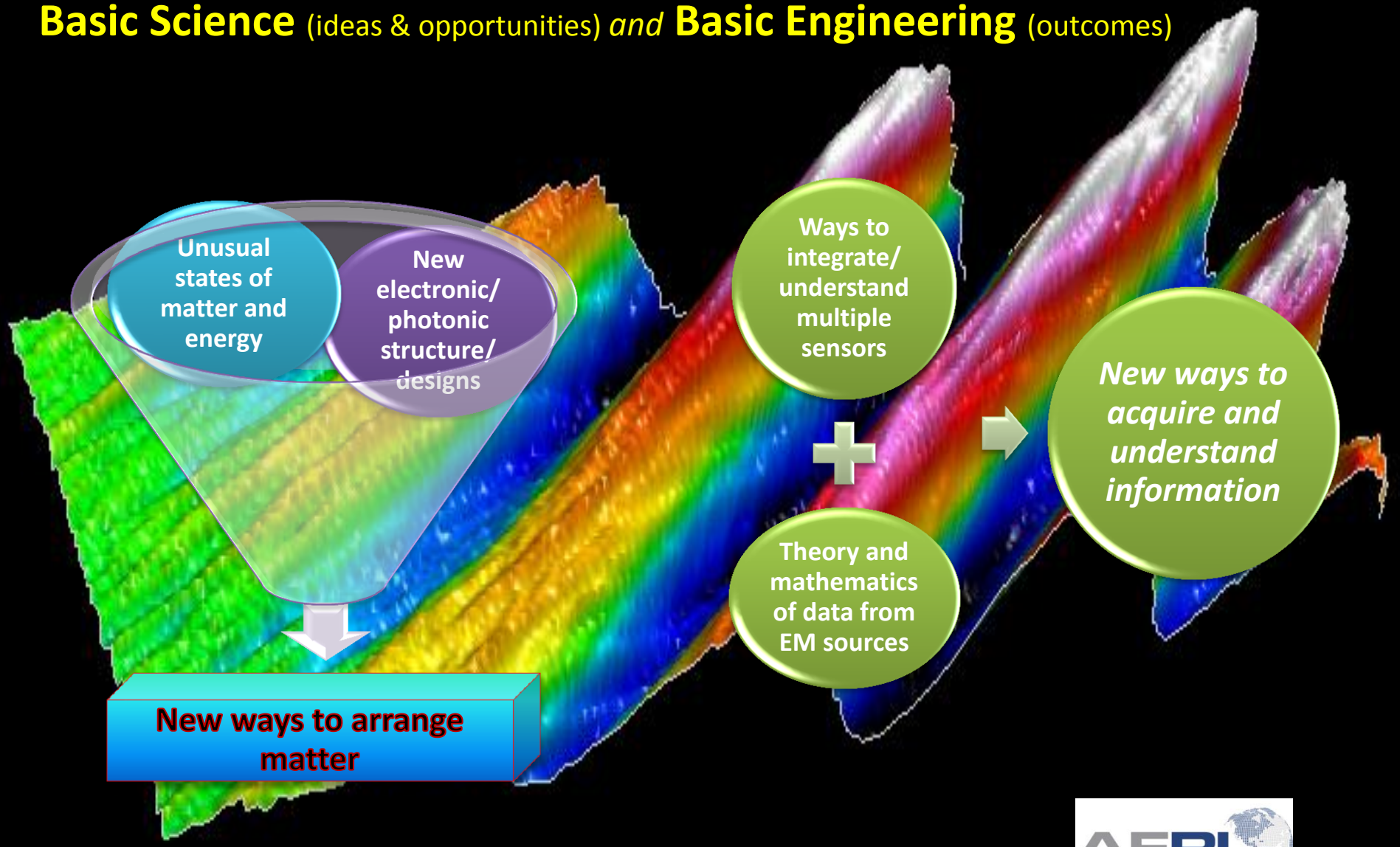
14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**8**	

Physics & Electronics: What we do

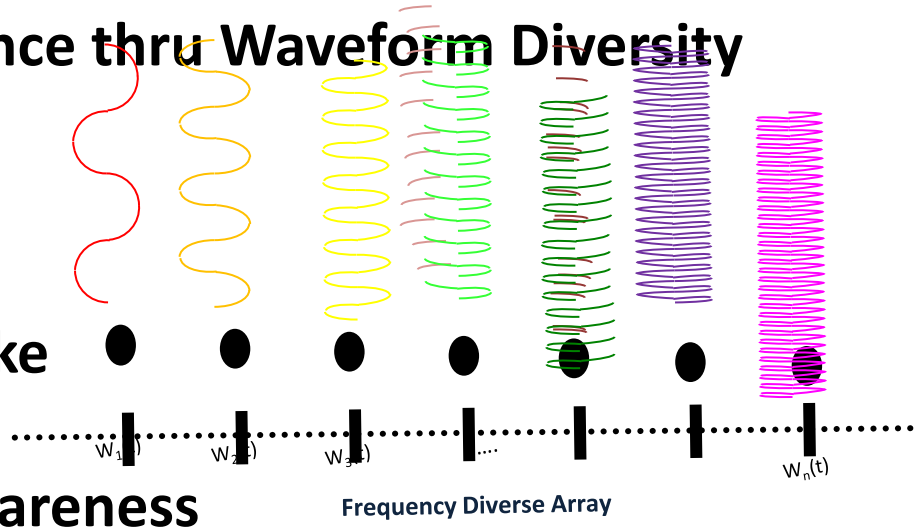
Basic Science (ideas & opportunities) *and* **Basic Engineering** (outcomes)



Opportunities in Physics & Electronics

Technology Horizons:

1. Precise Navigation/Timing Anywhere without GPS
2. EM Spectrum Warfare/Dominance thru Waveform Diversity
3. Intelligent Sensors
4. Directed Energy for Tactical Strike
5. Persistent Space Situational Awareness
6. Nanotechnology for Machine-Human Interface



Frequency Diverse Array

Opportunities in Physics & Electronics

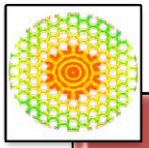
Grand Challenges: *Achievements requiring substantial basic research*

1. High Temp/Room Temp Superconductive Materials
2. All optical Computing
3. Fully Enabled Quantum Computers
4. Multi-MW-class Solid-State Lasers
5. High Resolution Imaging/ID of Objects in GEO
6. Full Prediction of Space Weather out to 72 hours

Who We Are

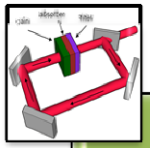
Physics, Physical Mathematics, Electronics

Dr. Patrick Carrick, SES, Director
Dr. Kathleen Kaplan, Deputy Director



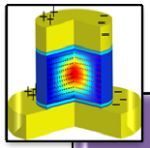
Physics

- Electro-Energetic Physics:
  - **Dr. John Luginsland**
- Atomic, Molecular, and Optical Physics:
  - **Dr. Tatjana Curcic**
- Ultra-short Lasers
  - **Dr. Enrique Parra**
- Space Sciences
  - **Dr. Cassandra Fesen**
- Imaging Physics, Remote Sensing
  - **Dr. Kent Miller**
- Laser and Optical Physics
  - **Dr. Howard Schlossberg**



Physical Mathematics

- Electromagnetics
  - **Dr. Arje Nachman**
- Sensing, Surveillance and Navigation
  - **Dr. Jon Sjogren**



Electronics

- Optoelectronics, Nanoelectronics, Terahertz Light Sources
  - **Dr. Gernot Pomrenke**
- Multi-Modal Sensing
  - **Dr. Kitt Reinhardt**
- GHz-THz Speed Electronics
  - **Dr. Jim Hwang (IPA)**
- Quantum Electronic Solids
  - **Dr. Harold Weinstock**

Other

- Space Weather Chair, NATO Study, YIP, PECASE, NSSEFF, HEL/JTO, University Nano-sat, Space Scholars, Akamai
  - **Dr. Julie Moses**
- Program Element Monitor
  - **Dr. Djuana Lea**
- Assistant Program Managers
  - **Mr. Brian Thomas**
  - **Ms. Evelyn Dohme**
- Support Specialist
  - **Mr. Melvin Jackson**
- Automation Clerks
  - **Ms. LaDonnia Lee**
  - **Ms. Jazmyne Bracey**
- Reservist:
  - **Maj. Erik Blasch**

Mission and Vision

We seek out and nurture fundamental advances in *physics and electronics* ....

Plasma physics and high energy density non-equilibrium processes

- space weather for improved dynamic space predictability
- ultra-short laser interaction with matter for diagnostics and communications
- pulsed power for directed energy
- plasmas and non-linear response of materials for counter DEW

Optics, electromagnetics, communications, and signal processing

- complex electromagnetic signals for propagation through complex media, communications, and advanced navigation
- optical imaging and adaptive optics for improved Space Situational Awareness
- new mathematics applied to complex physical systems & non-linear dynamics for counter DEW

Complex electronics and fundamental quantum processes

- new superconductors for power
- non-linear optical materials for sensor protection
- spintronic & photonic materials for computing
- multi-functional & multi-modal sensing
- metamaterials for ultra-small antennas
- systems with exotic quantum properties or structures & ultra-cold atoms and molecules for quantum information systems and quantum computing

Some outstanding FY11 research outcomes…